The Relevance of Scientific Dissemination during the Vaccine Campaign: The Italian Virologist Communication on Social Media

The scientist role has progressively gained an essential relevance along the 2020 pandemic. The virologists’ exposition turned out, in fact, as fundamental for the public opinion both for the well informed and not aware people about health, transmission, infection and, today, vaccines program. This paper aims to set a first explorative investigation about the social communication practices during the first three months of the vaccine campaign addressed by Italian most established virologists on social media. The arising of digital scenario and the resultant pervasive presence in our daily life of web platforms, such as social media, has revolutionized the nexus between science and society. More scholars argued about the disintermediated current shape of science communication that connect directly scientist and large publics, driving the sociological debate towards the analysis of the current processes of sense-making construction. On this assumption we aim to give answers to the research question referred about how do the Italian scientists communicate and approach large publics on social media. Therefore, the empirical part of this paper consists in a data collection phase conducted on Facebook and Twitter. The collected data have been analyzed by a content analysis oriented to identify the contradictory or uniformity of disintermediated communication features of the observed social media profiles in order to push and follow, during the ongoing vaccine dosing program, a proactive reflection about the key role of scientific dissemination.

Keywords: Communication of science, Scientists’ visibility, Social media communication, Content Analysis, Topic Modelling

The Communication of Science inside and outside the Digital Environment

The relationship between science and society has become nowadays increasingly relevant. Following Ancarani (1996) in fact, science, gradually, has been faced with a variety of politically relevant social and economic issues such as health, food, transport, communications, energy, innovation and so on., meanwhile the public space got transformed focusing citizens as «the depositary of the structures and processes of democracy as the power control, the delegation of people’s will, public discussion and public opinion» (Mazzoleni, 2004: 17).

Today, therefore, institutions representing science and the researchers themselves cannot neglect communication in their daily work (Scamuzzi and Tipaldo, 2015).

In particular, science’s public communication has an essential role to define the relationship between researcher and citizens (Bucchi and Trench, 2014) and now, a scientist is socially appreciated if he manages to reduce the
distance between these subjects. In this perspective is pointed the need for a close relationship between science and society, between experts and the public, in a process of involvement that allows us to grasp the urgent needs of humanity» (Pellegrini, 2018: 33).

Beyond the different levels of analysis of communicative phenomena and consistent models that have outlined the relationship between science, scientists and the various types of audience (Jasanoff, 1995), scientific communication studies agree about how the mediatic context is «a central variable for the regulation of the processes of constructing meaning, able to orient exchanges between the issuer and the recipient towards outcomes not at all obvious, even with equal content of messages» (Scamuzzi and Tipaldo, 2015: 68). In light of this assumptions, nowadays Internet represents certainly the mediatic environment that has succeeded in revolutionizing the communication of science simultaneously to its evolution. Firstly, intended as a canonical medium deputed to the information storage (read-write web), the web changed along last 20 years transforming itself in an integrated participative environment (people-centric web and participative web, Patel, 2013).

There are many web-based activities that scientists carry out daily, as for example documents transmission, magazines editing, data sharing, articles creation, publishing of conference proceedings and informal exchanges also i.e. videoconferences. In this way, Pellegrini and Saracino in fact argue about “Science 2.0” as an «increasingly widespread practice among scientists of publishing online experimental results, emerging theories, claims of discoveries and drafts of articles that anyone can read and comment on» (Pellegrini and Saracino, 2019: 76).

Furthermore, Science 2.0 cannot disregard a communication also through Social Media sphere, by which is possible to create networks of collaborations (think i.e. of Researchgate designed to allow relationships between researchers related to any type of discipline), to spread news and fight against scientific controversies: today science and society work together in fact also because they allow citizens in taking stand on scientific issues: a not practicable way until recently when was «an exclusive prerogative of the scientific community and political decision-makers» (Bucchi, 2010: 141).

Before Internet affirmation, the mainstream media as radio and Tv were the only promoters of communication of science to citizens although «by their nature they point out the evident asymmetry between the scientific community and the general public and the clear directionality of science communication» (Scamuzzi and Tipaldo, 2015: 150). In the past, traditional media acted as an intermediary between universities and the public sphere for example through press releases while, with the advent of digital, information shifted in an open access vocation, accessible to anyone is interested. In this way the online media offer to scientists more communication opportunities in dealing directly with the general public rather than having to rely on journalists as mediators (Peters et all., 2014).
The web, furthermore, connotes as an environment in which comes possible a greater participation about scientific knowledge and, at the same time, that can reveals traps related to scientific controversies or misinformation in the way that «the web breaks that sequential order and the tightness of a series of “filters” that previously distinguished the path of scientific results of the researcher to the general public» (Bucchi, 2006: 72).

Although its definite limits, «the web can allow a faster and immediate access to scientific information (possibility to access original papers, databases, contacts of researchers) » (Scamuzzi and Tipaldo, 2015: 150) and, in addition, social networks become useful tools to simplify the communication of science and its results as well the understanding of how a research has been led.

Following Bucchi and Saracino (2021), it is relevant finally to point out how the science communication concept for scientific argues has been recently rethought also due to the increasing of public demand about science and technology argues. It overcomes in fact the classical processes of mediated communication shifting to direct interaction between sender and public, driving towards a model pointed in 3 specific strategies (Pellegrini and Rubin 2019: 71-72):

1. The vertical one: featured by the direct dissemination of press release and scientists’ statements in order to spread the research outcomes to a general public.
2. The dialogic one: featured by discussion events between experts and publics duly shaped on new scientific topics.
3. The participative one: the last strategy concern the direct involvement of individuals in the research works in order to enrich the research purposes and shape the right interesting topics of investigation.

According with this background, this paper aims to shed light on the current relation between scientists and citizens in Italy. Though a first exploration oriented on the scientists’ social media presence, in fact, we will try to comprehend how they set their communication strategies and styles selecting as unit of analysis the cultural products of their posting activities. For this reason, the empirical part of our work starts from a specific research question: referring the topic of current vaccination campaign, how do the scientists communicate and approach publics on social media?

We tried to answer this question conducting a first explorative research related to the Digital Ethnography (Murthy, 2008; Coleman, 2010) in line with the Rogers vision of Digital Methods (2009). We in fact extracted the material directly connected with phenomenon observed making further a primary use of secondary web data. Later the data collection we set a content quantitative analysis of social media posts uploaded by selected subjects we observed on two specific social media platforms during the first 3 months of the vaccine dosing campaign in Italy, from December the 27th to March the 27th.
Crisis Communication in Time of 2020 Pandemic

Through traditional and digital media, scientific communication has taken on an important role during the Covid19 pandemic. In the specific case of Italy, it increased the exposure of several scientific experts: virologists, immunologists, and so on, who have provided to the large public important scientific information about health, transmission, infection and, today, vaccines program, but also well proper instructions to follow concerning the right behaviour to adopt to face the pervasive contagion (Brondi and Pellegrini, 2021). The speeches, often discordant especially in the first phase of the pandemic crisis, occurred on traditional media and social networks, with different styles.

The Covid-19 crisis poses in fact significant challenges for how science is conducted and communicated (Lasser et al., 2020). The 2020 agenda setting «was substantially monopolized by the Covid-19 pandemic, the most prominent feature in the news of the year» (de Sola Pueyo, 2021:1) driving towards the infodemic dimension intended, following Hua and Shaw (2020) as «the overabundance of information, sometimes not accurate, that creates difficulties for society to understand which resources to use to access reliable information» (de Sola Pueyo, 2021:1).

Following Wajahat Hussain (2020), in fact, through social and mass media is possible to transmit a sense of unity due to large public coverage as well the opposite: «Social media may also provide grounds for misinformation and discrimination. People can utilize the flexibility and pervasiveness of social media technologies to increase the public’s adherence to the safety measures suggested by global health organizations to combat the spread of covid-19».

Following Bucchi (1996) in certain situations, usually connected to scientific controversies, scientists start to address the public directly by skipping the usual stages of scientific communication in the way that «these situations create a new modality in science communication that is associated with different objectives and tactics compared to the traditional dissemination pathways» (Olesk, 2021: 6).

According with this assumption, the best way to address directly the public is through the architecture of digital scenario and the disintermediated communication assets of the web environment as i.e. the social media sphere.

Social media platforms such as Twitter or Facebook ensure, in fact, support and resilience between communities, «providing direct access to an unprecedented amount of content and amplifying rumours and questionable information» (Cinelli et al. 2020:1).

For Wajahat Hussain (2020), furthermore, the specialists are involved, in a time of crisis as the pandemic, to turn their expertise communicating their followers what’s happening and the situation overall in their premises at local, National and International level.

Among these, of course, there must necessarily be scientists with strong disclosure skills, called to deal with proper communication on social networks.
Research Design

To better comprehend which scientists involve in our exploration among the several ones who have progressively exposed disseminating their expertise also through social media during 2020, we referred to a recent study of Reputation Science, a research center specialized in crisis management consulting particularly addicted to the scientific context.

Figure 1. Virologists’ Overall

<table>
<thead>
<tr>
<th>Nome</th>
<th>Indice Alerta</th>
<th>Indice Coerenza</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fabrizio Pregliasco</td>
<td>4,15</td>
<td>9,41</td>
</tr>
<tr>
<td>Walter Ricciardi</td>
<td>4,00</td>
<td>6,41</td>
</tr>
<tr>
<td>Massimo Galli</td>
<td>3,80</td>
<td>7,07</td>
</tr>
<tr>
<td>Franco Locatelli</td>
<td>3,45</td>
<td>9,21</td>
</tr>
<tr>
<td>Roberto Burioni</td>
<td>3,45</td>
<td>4,01</td>
</tr>
<tr>
<td>Antonella Viola</td>
<td>2,86</td>
<td>7,49</td>
</tr>
<tr>
<td>Andrea Crisanti</td>
<td>2,60</td>
<td>3,29</td>
</tr>
<tr>
<td>Ilaria Capue</td>
<td>2,21</td>
<td>3,95</td>
</tr>
<tr>
<td>Giorgio Palli</td>
<td>1,86</td>
<td>3,29</td>
</tr>
<tr>
<td>Maria Rita Gismondo</td>
<td>-1,44</td>
<td>0,75</td>
</tr>
<tr>
<td>Alberto Zangrillo</td>
<td>-2,29</td>
<td>4,13</td>
</tr>
<tr>
<td>Matteo Bassetti</td>
<td>-3,42</td>
<td>8,02</td>
</tr>
</tbody>
</table>

Source: Reputation Science

This center synthesized a proper overall concerning the scientist visibility on mass and social media from February 1st to November 20th, duly defined rightly their public statements analyzed following two specific indexes: The alert index that concerns the most frequent opinion of the scientist related to the control and containment solution for the pandemic, while the coherence index concerns the contradictions of their public statements along last year.

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Later to an in-depth inspection of the biographies of all the scientists qualified in this overall we selected 5 of them rightly to their presence on the social media.

The Selected Scientists

The first one selected is Roberto Burioni: an Italian scientist with an international profile. He was, in 1988, Visiting Scientist to Center for Molecular Genetics to University of California of San Diego, while in 1991 he was Visiting Investigator at the Department of Immunology of the Scripps Research Institute La Jolla, California (USA) where worked in Dr. Dennis R. Burton lab.

In 2004, Roberto Burioni worked at the Faculty of Medicine and Surgery of the University Vita-Salute San Raffaele in Milan while today he’s currently Full Professor of Microbiology and Virology, as well the head of an immunological research laboratory. His researcher’ studies concerns the field of development of human monoclonal antibodies against infectious agents. Burioni became famous during the late 2010 years with his media interventions, especially on social media on the issue of vaccines to counter disinformation. His activity of scientific dissemination, always about vaccines, switched also on TV allowing his reputation to gain more visibility. In November 2018 he opened a website: Medicalfacts.it, dedicated to scientific dissemination in the medical field. In 2019 he founded the Association ”Pact for Science” whose goal is to enhance the scientific evidence at the basis of the legislative and government choices of all political parties.

He published several books of scientific divulgation and for this he wins also several prizes.

From the beginning of the pandemic crisis still today, he appears as regularly guest to the TV program “Che Tempo che fa” conducted by Fabio Fazio which airs every Sunday at dinner time on the national broadcasting service Rai3.

The second scientist involved in our exploration is Ilaria Capua, a virologist of national and international fame. In 2000 she developed the strategy Differentiating Vaccinated from Infected Animals (DIVA): the first vaccination strategy against avian flu, by which - with a test - is able to detect whether antibodies in a subject were induced by the vaccine or infection.

Ilaria Capua is responsible for an atypical action in the scientific field dated2006: she challenged the system - obtaining international resonance - deciding to make public the gene sequence of the avian virus. Then there was talk of the birth of "open-source science".

In 2013 Ilaria Capua decided to run for the Italian Parliament being elected as the leader of her Civic Choice party. From May to July 2015 she was Vice-president of the Chamber of Deputies in the Twelfth Commission (Social Affairs).

She was put to criminal proceedings then acquitted (for conspiracy aimed at the commission of crimes of corruption, abuse of office and illicit trafficking
of viruses) which causes considerable inopportuneness in her personal life. In September 2016, in fact, she decided to resign as a deputy and moved to Florida where she got employed as researcher.

In the United States she heads a department of the Emerging Pathogens Institute of the University of Florida. She later became director of the University’s One Health Center of Excellence.

Furthermore, she is currently a resident guest at Dimartedi, a program of the Italian TV channel La7.

Furthermore, we involved also Fabrizio Pregliasco a researcher of the Department of Biomedical Sciences for Health of the University of Milano Statale. He’s author of expert reports for European registration of a vaccine and flu medication. During his professional life he has collaborated in 12 clinical trials of vaccines and antiviral treatments. In 2015 he was selected as Director of Health at the Galeazzi Orthopaedic Institute in Milan. Subsequently he also became a consultant to the National Council of Economy and Labour(CNEL), as well as to the National Council of the Third Sector (social, economic and cultural reality in continuous evolution that includes bodies that are neither public nor commercial). Both these roles are carried out by the Ministry of Labour.

From 2013 he’s president of ANPAS (an association committed to provide public assistance). The efficiency in the activity of scientific dissemination is the primary reason behind the esteem that the community of experts has towards Fabrizio Pregliasco. During 2016 such an appreciation found concrete form in the conferral of National Scientific Medical Union of Information prize.

During the coronavirus emergency he is called to take on the role of scientific supervisor. A role assigned to cope with the many deaths that occurred in Milan at the Pio Albergo Trivulzio, an historic place of the city, residence for the elderly, which accommodates over 1000 patients.

After the numerous deaths and at the same time the assessment of responsibilities, his role helped Pio Albergo Trivulzio to implement a new organizational structure.

He is sporadic guest in TV programs on La7 and Rai channels.

Antonella Viola took place among the scientists observed in our research also. She took a prize assigned in 2014 by the European Research Council a scholarship: two and a half million of Euro in recognition of Steps project considered a revolutionary program with regard to the evidence on immune defenses against cancer. In the same year, she became associate professor in General pathology at the Department of Biomedical Sciences of the University of Padua. Today she is also a member of the scientific committee of the Italian Association for Cancer Research, as well as being an auditor for the European Commission dealt to the evaluation of scientific excellence projects. Thanks to her contribution to molecular biology Antonella Viola becomes part of the European Molecular Biology Organization.
Finally, in parallel to her teaching and laboratory activities, she’s responsible for promoting scientific dissemination, especially in the framework of the European project Eufactor\(^2\).

The scientist is also particularly appreciated as a speaker: her clear style leads her to travel the world as a speaker at conferences at prestigious institutions. Between the most appreciated speeches are those at TED Talks.

She is a sporadic guest for TV programs on La7 Channel and on Radio Radioradica.

Finally, the last scientist selected is Alberto Zangrillo, head of the Operative Unit of Anesthesia and General Reanimation and Cardio-Thorax-Vascular, Head of Clinical Areas of the IRCCS San Raffaele Hospital in Milan and collaborates at the La Madonnina Nursing Home.

He’s professor pro-rector and Full Professor of Anesthesiology and Rianimation. Following Scopus’ sources today he is one of the top ten doctors in the world for the number of publications in the field of “anesthesia” and "intensive care", author of since 800 publications, of which 400 on index international journal that include randomized studies in The New England Journal of Medicine, JAMA, Circulation and British Medical Journal.

His media experience is linked with the former Prime Minister Silvio Berlusconi. Zangrillo has always been at his side, especially in the most health difficult moments such as in 13\(^{th}\) December 2009 when Silvio Berlusconi (at that time Prime Minister) was hit by a small mermaid; or seven years later, when the leader of the centre-right party was subjected to a decidedly complex cardiac intervention at the San Raffaele.

By virtue of its authorial activity he collects numerous awards and honours from the scientific community. Also the institutional offices seem to recognize the merit and confer the merit titles by the Presidents of the Italian Republic, Carlo Azeglio Ciampi and then Giorgio Napolitano.

He takes part sporadically to TV programs on Rai, Mediaset and LA7.

\(^2\)The project of 2016 is aimed at young people between 16 and 19 years and was created to raise awareness of the study of science, technology and computer science, directing them towards training and professional paths that offer more opportunities, but they are often discarded because they are considered difficult or boring. The campaign also targets stakeholders and the general public, to draw attention to the importance of science and technology and to give visibility to the European Union’s commitment in these areas.

\(^3\)SCOPUS is currently the largest bibliographic database of abstracts and citations of scientific literature. Index over 17,700 titles of scientific, medical, technical and humanistic journals, published by over 4,000 publishers. Among the most important citation functions Scopus allows to obtain: the H-Index or Hirsch Index (proposed in 2005 by Jorge E. Hirsch of the University of California at San Diego), is a bibliometric indicator that measures the impact of authors within the reference scientific community, based on number of publications and number of citations received; -to carry out the citation analysis of the authors and their relatives publications (through the Citation Tracker); to carry out the research and analysis of the authors' profile and membership affiliations.
Methodology

Social platforms and data collection

As context unit, we selected two specific social media platforms: Facebook and Twitter.

In a recent study, the research center Observa – Science in society (2019) returned, in fact, interesting results relates about how Facebook turn out to be a very suitable social platform by which Italian citizens are reached from scientific-health centered contents and by which their fruition comes more frequent, while on the other hand Twitter turn out to be the opposite.

Table 1. Reading and sharing of contents concerning health and medicine (valid % N=978)

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Sometimes</th>
<th>Frequently</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facebook</td>
<td>25.5%</td>
<td>52.7%</td>
<td>21.8%</td>
<td>100%</td>
</tr>
<tr>
<td>Twitter</td>
<td>67.4%</td>
<td>24.6%</td>
<td>8%</td>
<td>100%</td>
</tr>
</tbody>
</table>

Source – Observa science in society

According to this evidence, more scholars (Schultz, Utz and Goritz, 2011; Eriksson and Olsson, 2016) argued about the perceived usefulness of Facebook and Twitter in crisis communication. In particular, compared to other sources related to the digital scenario, Twitter leads to less negative reactions than blogs and newspaper articles, while Facebook results in a higher reputation and less secondary crisis reactions than crisis communication via an online newspaper (Eriksson and Olsson, 2016: 200).

On the base of this assumptions we started the data collection procedure on Twitter availing of scraping procedure via Python syntax while for Facebook we availed of the use of CrowdTangle, an insight tool reserved to the academic hub that only tracks public available posts on Facebook, Instagram and Reddit.

The data have been collected following the structure of a proper standard gather grid (Losito, 2003; Amaturo and Punziano 2013) divided in 4 main domains (General information, Cross information, Engagement and audiovisual and text information) and then organized in a Cases per Variable Matrix composed by 1306 observations per 13 variables defined as follows:
Table 2. Standard gather grid

<table>
<thead>
<tr>
<th>General Information</th>
<th>Cross Information</th>
<th>Engagement</th>
<th>Audiovisual and Text Information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Account</strong> (Viola, Burioni, Capua, Zangrillo, Pregiarsco)</td>
<td><strong>External Sources</strong> (No external source, Press, Institution and Government, Science Journal, Scientific Network, Scientific Press, Conference Promotion, Official website)</td>
<td><strong>Like</strong> (Low, Medium and High Likes)</td>
<td><strong>Audiovisual Description</strong> (No audiovisual elements, Data, infographics, Media promotion, Normative alert, personal promotion, Press screenshots, Scientific publication extracts, Social media screenshots, visual and logo, Web events)</td>
</tr>
<tr>
<td><strong>Date</strong> (December, Early January, End of January, Early February, End of February, March, Early March, End of March)</td>
<td><strong>Repost Account Source</strong> (original post, Repost from Press Institution and Government, Repost from Scientific network and Scientific Journals, Repost from other profiles)</td>
<td><strong>Comments</strong> (No Comments, Low-medium comments and high comments)</td>
<td><strong>Text</strong> (Post corpus)</td>
</tr>
<tr>
<td><strong>Platform</strong> (Twitter, Facebook)</td>
<td><strong>Tag</strong> (No Tag, Institution, Press and other profiles Tag, Scientific network and Scientific journals Tag)</td>
<td><strong>Share</strong> (Low, medium and high share)</td>
<td><strong>Text length</strong> (Short, medium and long length)</td>
</tr>
<tr>
<td><strong>Post Type</strong> (Tweet, Retweet, Tweet Photo and Video, FB Status, FB Status Repost, Facebook Photo and video, Facebook Photo and video Repost, FB Link)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2
The selected scientist proper profiles find place in the account variable while date variable concerns the month when posts have been uploaded. All contents have been classified due to the platform uploading (Twitter and Facebook) and rightly of its classification unit (audiovisual or textual) duly specified in the Post type variable by which furthermore come possible to recognize the original or repost contents.

The external sources concern the context from which comes the external links tied to the posts while the variable named Repost Account Source relates the categorization of the account from where come the only reposts. All Tags in posts have duly found place by a right categorization of the other mentioned Social media accounts. For what concern the engagement, Like, comments and share have been classified in tercile intervals that match low-medium and high engagement levels, while pictures and video description have been categorized by the symbolic representation of audiovisual material posted in audiovisual description variable. Finally, we collected the text of every post as well the text length properly classified following short-medium and long criteria cutting tercile intervals.

All the information contained in the dataset have been processed following a multi-stage analytical procedures consisting in the application of the topic modelling aimed to point the features of the vaccination program discussion on social media during the timespan we observed and then in the application of the Multiple Correspondence Analysis (MCA) that make possible to detect the latent dimensions by which mark the correspondence between topics and the other context variables (platform, type of post, engagement and external sources). Later, the Lexical Correspondence Analysis (LCA)\(^4\) turned out to be the best way to a right synthesis of the collected data: by a compact graphic representation of data relations projected on factors, we could point concepts not previously observable by which find the right key-interpretations based on the correspondence between the selected variables and most characteristics words of post texts.

Analysis and discussion

The Topic modelling

The post texts present a considerable amount of information by which is difficult to trace a semantic structure. For this reason, we offered the empirical base to a simple but statistically robust solution: the topic modelling.

As first step we imported the database in T-Lab, a specific software environment for the content analysis able to process proper patterns based on

\(^4\)The LCA is a factorial technique concerning textual data and useful to: synthesize information contained in texts; make graphic displays of association networks among words and between words and texts; show the connections between text and context data. (L. Lebart, A. Salem, L. Berry, Correspondence Analysis of Lexical Tables, in Exploring Textual Data, in L. Lebart, A. Salem, L. Berry (eds.), Springer Sciences & Business Media, Dordrecht 1998, pp. 45-79.
We submitted the text variable, consisting in the corpus extracted by Facebook and Twitter, to T-Lab thematic analysis procedure that is preceded first of all by the proper following automatic processes: Lemmatization, consisting in 1) the standardization of all the verb forms in the same mode 2) the transformation of nouns and adjectives posed in singular number 3) the removing of definite-indefinite articles; Frequency threshold put on 20 occurrences that drove us to exclude in the analysis all the words below this frequency value and reducing finally the database to 650 total words; finally we proceeded with the exclusion of empty segments not significant and relevant for our analysis. Later we setup the modeling aimed to the topic extraction based on the Latent Dirichlet allocation (LDA) a «generative probabilistic model for text document collections based on a three-level hierarchical Bayesian model, in which each item of a collection is modeled as a finite mixture over an underlying set of topics. Each topic is, in turn, modeled as an infinite mixture over an underlying set of topic probabilities. In the context of text modeling, the topic probabilities provide an explicit representation of a document» (Blei, Ng and Jordan, 2003). Following this procedure, we extract 10 topics properly renamed respecting statistical criteria, such as the consideration of specific words occurrences featuring the topic as well the low-high shared words occurrences among all topics, and by the semantic tagging (Bolasco, 2013: 126) on selected context in order to «detect the right document meaning solving disambiguation and identifying concepts by a set of words».

Finally, we classified the 10 topics taking account of its 985 emerging elementary contexts intended as the document analyzed fragments in which the topic itself comes more relevant.

Following Habert (2005), in fact, the more significance parts of documents is supposed by the information weight of its fragments featured by its discursive formulas, their position in the document, the specific weight of each word related its scatter in the document etc. In our case, the resume of elementary contexts T-lab returned us followed a hierarchical order based on the informative score of single fragment, which text reduction has been synthesized by 95 % threshold.

The emerged topics have been duly defined as shown in table 3:

<table>
<thead>
<tr>
<th>Topic Name</th>
<th>Most frequent Words (Specific, Shared with high probability, Shared with low probability)</th>
<th>Elementary context examples</th>
</tr>
</thead>
</table>
Difficile - a far saltare i numeri sono entrate in scena le nuove varianti virali. La presenza delle varianti del virus nel nostro Paese desta giustamente preoccupazione, non solo per la loro maggiore trasmissibilità ma anche, nel caso delle varianti brasiliana e sudafricana.

**Effectiveness of Vaccine**

| Infezione, Dose, Paziente, Prima, Anticorpo, Usare, Rispondere, Protezione, Approvare, Risposta, Gravi, Domanda, Basare, Immunità, Risultato, Generare, Immunità, Plasmare, Settimana, Sistema |
| - risposta a una singola dose di vaccini che devono essere somministrati in due dosi, ma purtroppo suggerisce che per questi pazienti bisognerà pensare a forme di protezione diverse. Aspettiamo i risultati della seconda dose. |
| - La protezione completa si stabilisce 7 giorni dopo la seconda dose, quella parziale 12 giorni dopo la prima dose. |

**AstraZeneca Case**

| Vaccinare, Persone, AstraZeneca, Popolazione, Decidere, Uscire, Somministrazione, Ricevere, Problemi, Rispetto, Evento, Contagio, Riguardare, Accadere, Fiducia, Evitare, Lotto, Anziano |
| - L’AIFA ha giustamente deciso di non consigliare l’utilizzo del vaccino AstraZeneca per gli over 55. Questo perché non ci sono dati solidi sull’efficacia del vaccino in questa fascia di età e perché è comunque un vaccino meno efficace rispetto agli altri, riuscendo a proteggere solo 6 persone ogni 10 vaccinati. La mia domanda però è la seguente: che facciamo con i 40enni diabetici? |
| - Ricevo richieste da parte di chi è stato vaccinato con il lotto AZ temporaneamente bloccato da ISS. Il lotto non è “difetto” come mi scrivete la sospensione è precauzionale e se siete stati vaccinati non dovete fare nulla. La febbre è comune con questo vaccino. Niente panico. |

**Relevance of Data**

| Dati, Efficacia, Rischio, Efficace, Clinico, Malattia, Studio, Sudi, Moderno, Dimostrare, Bloccare, Sicuro, Soggetto, Ridurre, Funzionare, Ottenere, Comunità |
| - I vaccini funzionano contro le nuove varianti? Cominciano ad arrivare i primi dati Uno studio in revisione e i dati ottenuti da Moderna indicano che gli anticorpi generati dai vaccini a mRNA continuano a riconoscere le varianti ma con minore efficienza. Moderna ha già annunciato di aver iniziato a generare una versione aggiornata del vaccino. |
| - Ci eravamo basati sui dati pre clinici per dire che i vaccini a mRNA facevano ben sperare che anche l’infezione fosse bloccata e che saremmo rimasti in attesa di ulteriori dati. |
| Preparation of Vaccine Campaign | Vaccinazione, Italia, Paese, Noi, Sanitario, Campagna, Scientifico, Effetto, Scuola, Giorno, Cittadini, Situazione, Scelta, Trovare, Numero, Alto, Grave, Prendere, Ricordare, Necessario | - Io m'aspettavo un clima tutto diverso per questa campagna di vaccinazione. Una mobilitazione febbrile, centri di vaccinazione aperti ventiquattr'ore, un attivismo generoso Un'atmosfera potente, commovente, da trincea, da ultima spiaggia |
| Vaccine’s Supply | Tempo, Arrivare, Anno, Produzione, Produrre, Possibile, Primo, Milioni, Pensare, Caso, Ritardo, Disponibile, Sicurezza, Differenza, Unico, Unito | - BioNTech, l’azienda che ha messo a punto uno dei due vaccini a mRNA, in settembre ha comprato da Novartis una fabbrica per dedicarla alla produzione del vaccino. Ha impiegato 28 (ventotto) giorni per adattarla, 60 per cominciare a produrre concretamente il vaccino. Nel dettaglio: Settembre acquisto azienda, Ottobre novembre progettazione, Inizio dicembre domanda per adattamento. - Si parla con enorme interesse del vaccino russo Sputnik, addirittura immaginando di produrlo noi e prima ancora di aver ottenuto l’approvazione da EMA o FDA. Lasciando da parte interessi politici ed economici, non si comprende perché mai dovrebbe interessarci proprio questo vaccino e non quello di Johnson&Johnson. Entrambi i vaccini si basano sullo stesso vettore adenovirale |
| Response Capabilities | Pfizer, Notizia, Dosi, Giorni, Proteggere, Europa, EMA, Fase, Sperare, Pubblicare, Continuare, EU, Problema, Partire, Ottimo, Morto, Italiano, Iniziare, Insieme, Possibilità | - "Ottima notizia: Dopo milioni di dosi somministrate (due anche a me) l’EMA conferma la sicurezza del vaccino Pfizer BioNTech PS dopo la seconda dose male al braccio, lieve mal di testa, dolori muscolari ma 15 giorni fa dopo un’incauta partita a tennis stavo molto peggio." |
- Il vaccino Pfizer sembra proteggere dall'infezione già dopo una singola dose. Questa è davvero la migliore notizia degli ultimi tempi! Non sappiamo però quanto dura la risposta immunitaria quindi per il momento avanti con le seconde dosi nei tempi indicati e avanti coi vaccini!

<table>
<thead>
<tr>
<th>Scientists’ reputation</th>
<th>Burioni, Roberto, Medico, Vedere, EricTopol, Vaccine, Chiedere, Leggere, Tweet, Conoscere, Iene, Correggere, Lavoro</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Io avrei riportato le fonti, ma egualmente domani i giornali avrebbero titolato “risa tra scienziati”, “i medici devono mettersi d’accordo tra loro prima di parlare “o il classico “qui nessuno ci capisce niente. - n ogni caso già sono abbastanza conosciuto Ho cancellato il tweet e non vado a letto con il timore i leggere domani gli articoli dei soliti giornali che mi infamano e gli sberleffi dei frustrati di Twitter che mi riversano addosso il loro odio, entrambe cose non importanti, ma non piacevoli Per cui ho cancellato il tweet.</td>
<td></td>
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<tr>
<td>- chetempochefa Stasera ‘, tornerà a #CTCF da ', fabfazio Con il professore parleremo delle ultime notizie sul peggioramento dei casi covid in Italia e della situazione dei vaccini Vi aspettiamo dalle 20 00 su ', RaiTre. - Adnkronos #CovidItalia, ‘Varianti Vera emergenza “Covid Italia, Pregliasco “Varianti vera emergenza “Secondo il virologo servono azioni mirate e tamponi nelle scuole “Le prossime tre o quattro settimane le più delicate’</td>
<td></td>
</tr>
</tbody>
</table>

Multiple Correspondence Analysis (MCA): The factors’ building

Further the topics, as active variables useful for the factor building were pointed also engagement rates, platforms, type of post and date.

Scientists’ reputation and media presence topics characterized in the same way both the two factors, while the topics Virus Mutation, Effectiveness of Vaccine, AstraZeneca Case and Relevance of Data, instead, characterized the first factor, posed on the horizontal axis, which reflects the argumentations related to the vaccine clinical value assessment divided in two characteristic parts. As shown by Fig. 1, on the right side, renamed “Discussion introduction” in fact, we can notice low engagement and no topics emphasized on the factor, while on the left side, renamed “Controversial discussion” we can notice high engagement levels appeared on February turn and corresponding to controversial and delicate topics as the withdrawal of AstraZeneca batches and Vaccine effectiveness. For these argumentations Facebook and its relatively
post types appears as the most used platform by the observed scientists, while
for the quieter discussion the elected platform is Twitter.

The second factor, posed on the vertical axis, is characterized by topics as
Vaccine campaign preparation, scientific network, vaccine supplies and
response capabilities. This dimension reflects the vaccination plan features and
is divided in two specific phases of our timespan of observation. First two
months in fact reflect the run up of the campaign while the last two months
refers to the follow-up and rating of the ongoing process of vaccine dosing
program.

The plan synthesizes how most of the observed subjects are more addicted
to Twitter posting practices compared to Facebook which is more preferred
only by Antonella Viola. The most of them prefer a social media exposition on
Twitter that, following Eriksson and Olsson (2016), connects the microlevel of
interpersonal communication, the meso-level of follower–followed networks
and the macrolevel of hashtag-based exchanges, while Facebook is usually
preferred for horizontal support among users during crisis situation as the
pandemic, in this case electing a posting-logic based on original contents
(Viola, Burioni and Zangrillo) or on shared post from other social media
accounts (Capua and Pregliasco).

Antonella Viola looks to be the only scientist open to controversial
discussion. Her position on plan, in fact, clears how she benefits of high
reactivity by her followers instead of Ilaria Capua and Fabrizio Pregliasco,
more oriented to quieter exposition about the vaccine argumentation, which
posts are in fact characterized by low likes, comments and shares. Lastly,
Roberto Burioni and Alberto Zangrillo communication is characterized by a
medium degree of reactivity of his followers. By the way, we must point that
the scientist of Istituto San Raffaele in Milan closed the comments options to
all his followers, even that for his following accounts or the ones he
spontaneously refers by a mention in the posts or in comments.
Figure 2. Multi-correspondence Analysis
The Lexical Correspondence Analysis (LCA)

Later to this first analysis procedure we more synthesized the information contained in our data providing the further explorative step of Lexical correspondence analysis (LCA) and show the multiple correspondences between words and context elements as for example who spread the message and the platform by which has been uploaded.

Starting from the right side we can see reflected a relevant mass media exposition of the selected scientists. On both the up-down side are indeed marked words as: Dimartedi, the TV program that hosts Ilaria Capua as well as chetempoche, the TV program that hosts Roberto Burioni every day at dinner time, duly complemented by the main character of their research network as , One Health UF and Elastico, the research centers and association tied to Ilaria Capua, as Eric Topol and Eran Segal, two co-author scientist of Roberto Burioni and Anpasnazionale, the association which Fabrizio Pregliasco is President. These contents, posted along the timespan we observed and crossing the discussion introduction about the vaccine campaign, reflect how the positioned scientist in this side follow a kind of hybrid disintermediation made by a social-mediatisation process: they in fact disseminate via social media their statements originally conceived for mass media, finding on the web a new resonance chamber where spread the research outcomes to Twitter’s general public reluctant to react. On the other side, where the controversial discussion cross the timespan observed, a dialogic strategy is applied by only Antonella Viola. The high engagement levels in fact remarks an open possible discussion between the author and her public towards new scientific and mutable topics as the vaccines and its effectiveness due to the virus mutation as marked by words as: risk, worry, mutation, production, effectiveness, data, lockout etc. In this way, not relating with mass media frame, Antonella Viola looks as the only scientist truly according with a pure disintermediating process featured by contents thought specifically for the social media and the digital languages that promote a direct contact between sender and receiver, making outdated the figures deputed as intermediate in the communication processes.
Figure 3. Lexical correspondance Analysis
Main conclusions and further research perspectives

This first exploration has finally shown how the most accredited Italian scientists set their public exposition related to the new media sphere. The main hybrid approach, followed by most of the scientists observed, can be related to several factors on which focus later for further needed deepening that must be planned also by continuing to follow the vaccination program and its communication trends held abroad. A further comparison between Italy and other European Countries could be in fact useful in order to better comprehend these factors. More European Countries, such as France, Germany and UK, in fact, frame the communication of science availing of few experts officially related to Governments and Institutional research agencies. In this way, the Italian framing turns out to be more liberalized in terms of contribution for the public scientific debate, suggesting that the distance from a pure disintermediated digital vocation could not only be related to the idea of Italy as a laggard Country in terms of adaptation to the innovation in communication, while as sociopolitical context where arises a particular relation between science and politics. In this way, for example, we can wonder if the political sphere influences the scientific communication, scientists’ interests, strategies and exposition styles related to this fundamental step fighting the pandemic.

Considering what has been shown, a further research perspective can be for example oriented on the base of the following hypothesis examples:

The social media use of Roberto Burioni seems to be as resonance chamber of the framing processes he leads in TV, while Ilaria Capua adapt her twitter account as a promotion space while her Facebook account as a press office managed by third people. Do they don’t address controversial argumentation to protect their reputation and avoid troubles with the public broadcasting service? Does Pregliasco do the same to stay far by any ideological or political polarization misunderstanding rightly of his government collaboration? Reading the Science Reputation overall, Zanigrillo has been qualified as the most contradictory scientist. Does he keep a low profile to avoid any other public embarrassment?

In conclusion, in light of this first exploration, becomes needed a more required deepening of the scientific communication frame worked during the pandemic era, maybe starting from the above mentioned example-questions. Moreover, since we’re talking about a current and an in progress mutable phenomenon, we’re forced to press further on our investigation following and observing the related events that feature the vaccination issue due to the multiple surprises and releases that the vaccinal program can reserve in terms of scientists exposition in the public debate.
References

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